

[Bone](#). 2007 Nov;41(5):794-803. Epub 2007 Jul 25.

## **Influence of physiological effort of growth and chemical composition on antler bone mechanical properties.**

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### **Source**

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### **Abstract**

Antler is a good model to study bone biology both because it is accessible and because it grows and is shed every year. Previous studies have shown that chemical composition changes as the antler is grown, implying constraints in mineral availability and the physiological effort made to grow it. This study aimed at examining antler mechanical properties to assess whether they reflect physiological effort and whether they are associated with precise mineral bone composition rather than just ash content, which is usually the main factor affecting mechanical properties. We examined Young's modulus of elasticity (E), strength, and work to maximum load, as well as bone mineral composition, along the antler shaft. Then we compared trends between antlers from two populations: captive, well-fed, health-managed deer (n=15), and free-ranging deer with lower food quality and no health treatment (n=10). Greater E, strength and work were found for better fed and health managed deer. In addition, antler chemical composition of both populations differed in Na, Mg, K, Fe and Si, and marginally in Zn, but not in ash or Ca content. Significant and clear divergent trends in mechanical properties supporting greater physiological exhaustion in free-ranging deer were found for all mechanical variables. Detailed models showed that, in addition to ash content, independent factors extracted from principal component analyses on composition affected E and strength, but not work to maximum load. The results suggest that there is an association between bone chemical composition and mechanical properties independently of ash content.

PMID: 17822969 [PubMed - indexed for MEDLINE]